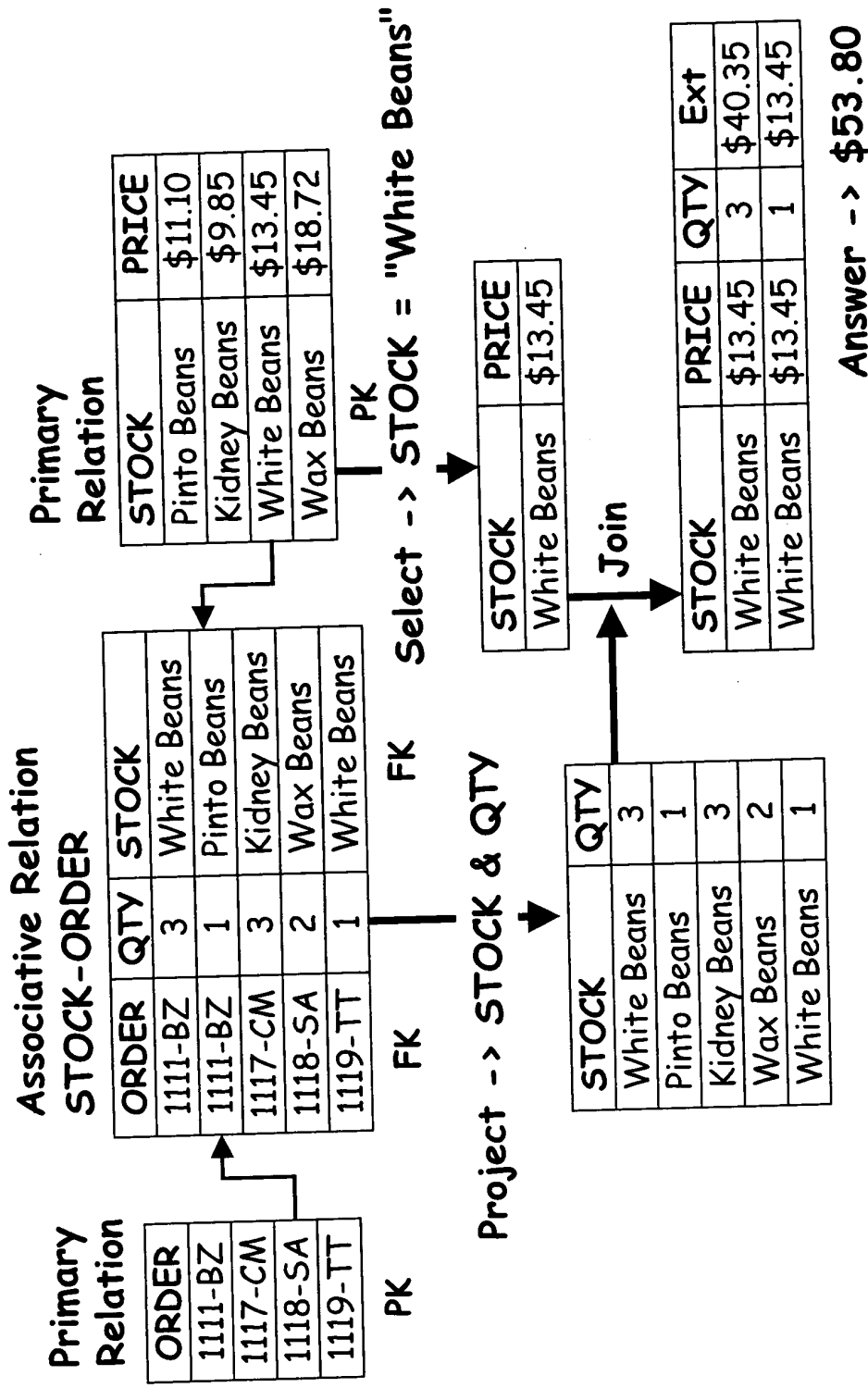
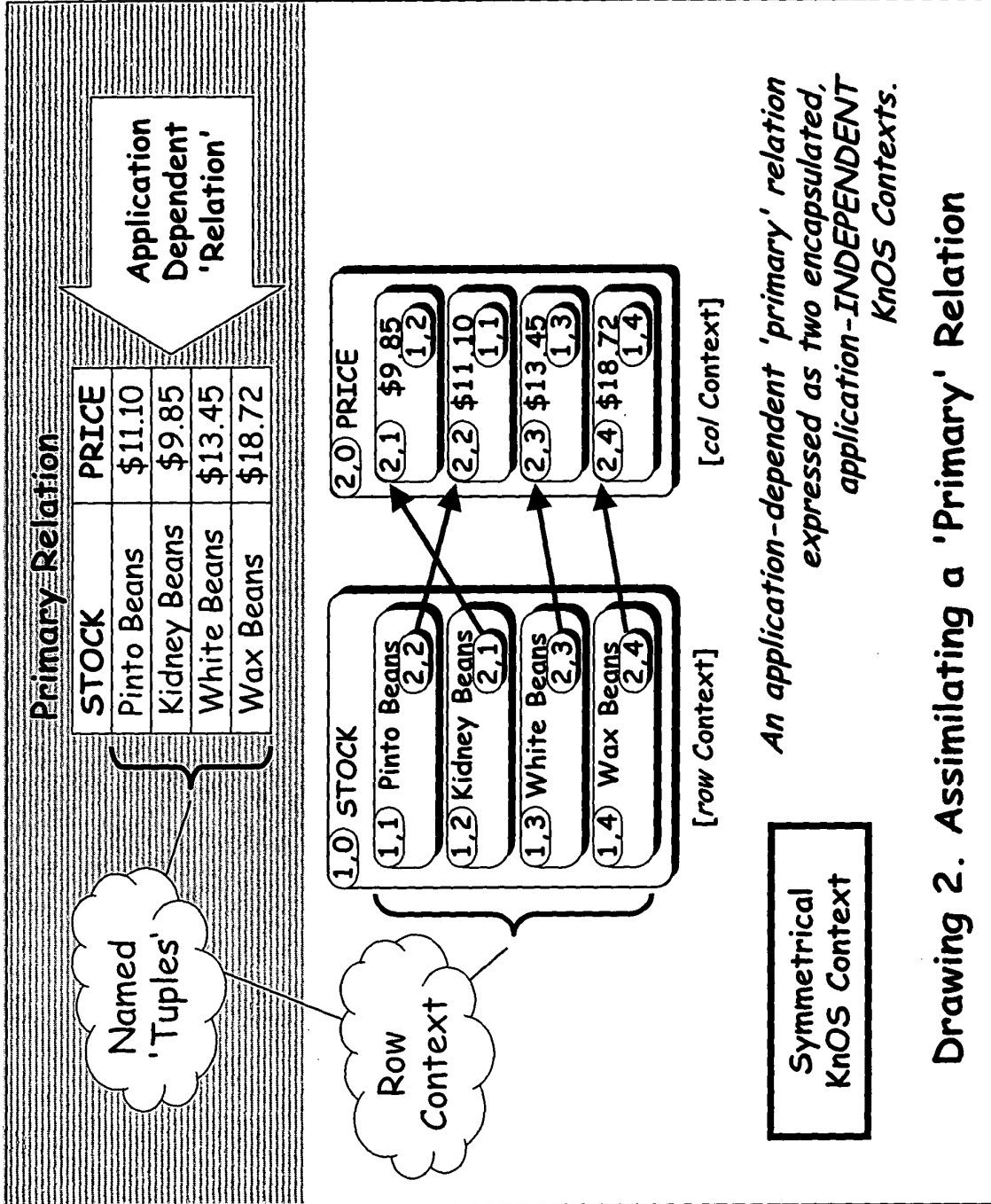
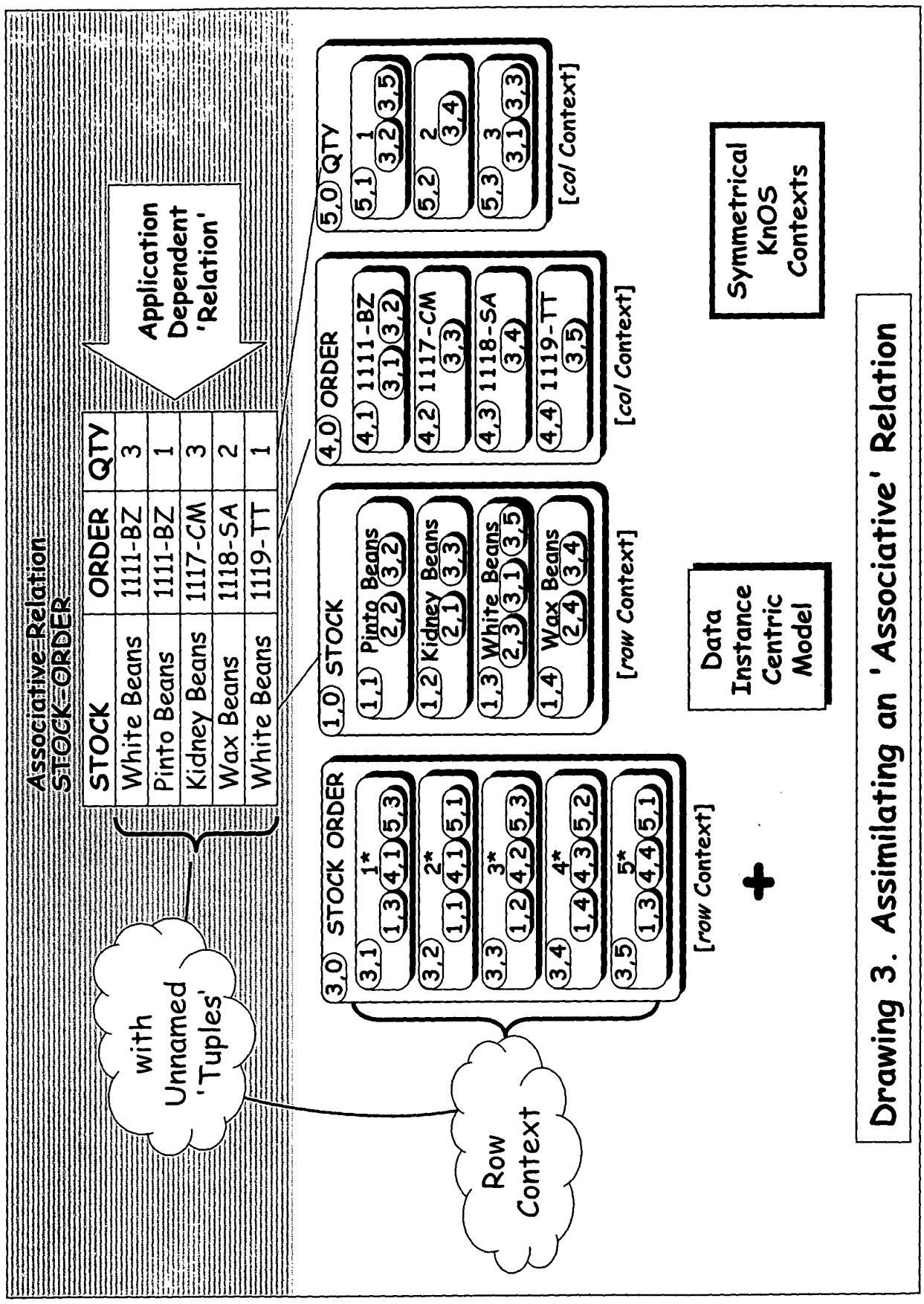


What is the total PRICE of 'White Beans' on all STOCK-ORDERS?

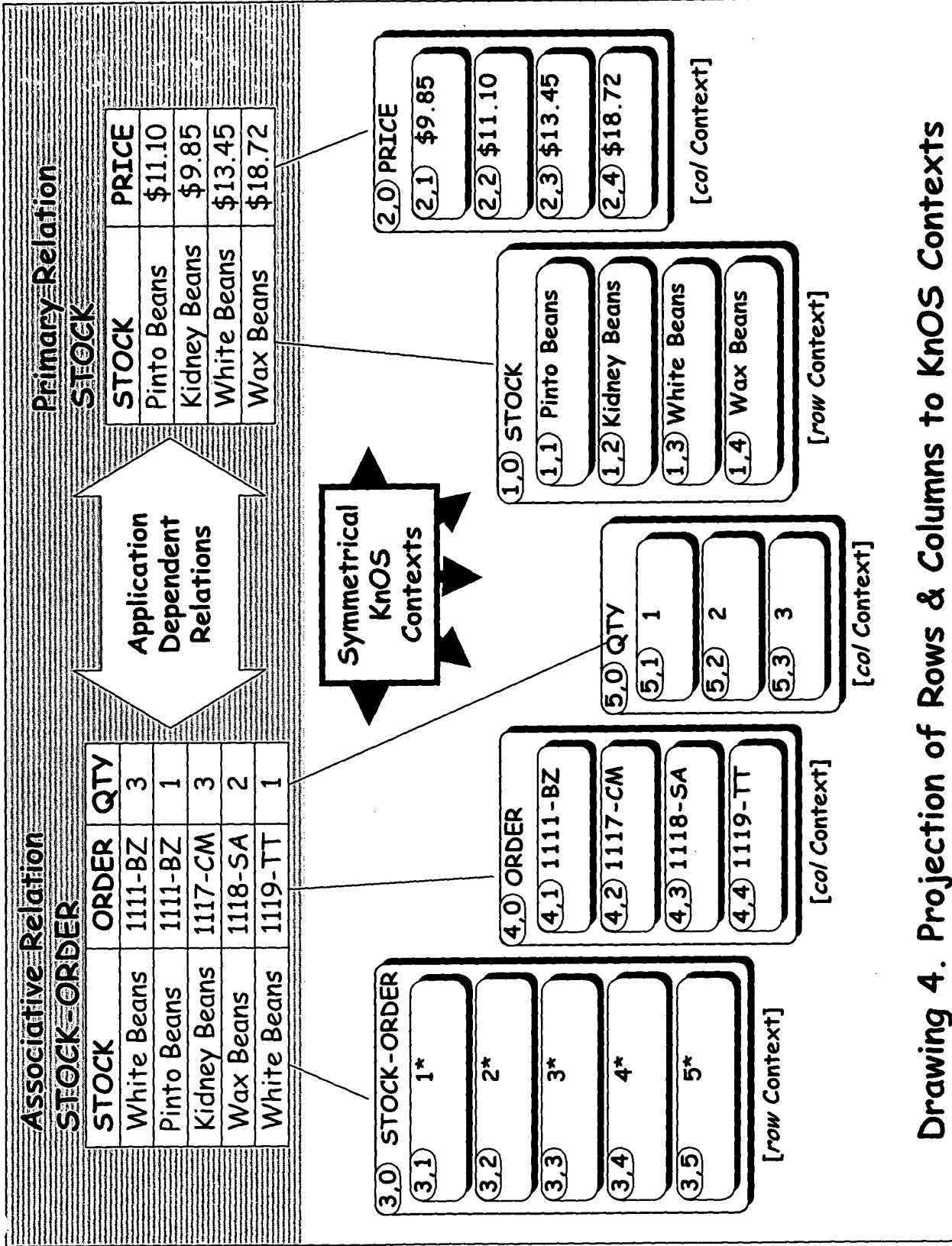


Drawing 1. Relational Model





Drawing 3. Assimilating an 'Associative' Relation



Drawing 4. Projection of Rows & Columns to KnOS Contexts

Associative Relation

STOCK-ORDER

STOCK	ORDER	QTY
White Beans	1111-BZ	3
Pinto Beans	1111-BZ	1
Kidney Beans	1117-CM	3
Wax Beans	1118-SA	2
White Beans	1119-TT	1

Primary Relation

STOCK

STOCK	PRICE
Pinto Beans	\$11.10
Kidney Beans	\$9.85
White Beans	\$13.45
Wax Beans	\$18.72

Application
Dependent
Relations

Symmetrical
KnOS
Contexts

3,0	STOCK-ORDER
3,1	1*
1,3	4,1
5,3	
3,2	2*
1,1	4,1
5,1	
3,3	3*
1,2	4,2
5,3	
3,4	4*
1,4	4,3
5,2	
3,5	5*
1,3	4,4
5,1	

[row Context]

4,0	ORDER
4,1	1111-BZ
3,1	3,2
4,2	1117-CM
3,3	
4,3	1118-SA
3,4	
4,4	1119-TT
3,5	

[col Context]

5,0	QTY
5,1	1
3,2	3,5
5,2	2
3,4	
5,3	3
3,1	3,3

[col Context]

2,0	PRICE
2,1	\$9.85
1,2	
2,2	\$11.10
1,1	
2,3	\$13.45
1,3	
2,4	\$18.72
1,4	

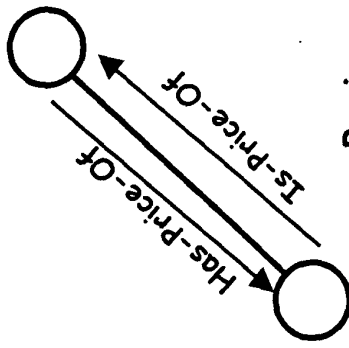
[col Context]

1,0	STOCK
1,1	Pinto Beans
2,2	3,2
1,2	Kidney Beans
2,1	3,3
1,3	White Beans
2,3	3,1
3,5	
1,4	Wax Beans
2,4	3,4

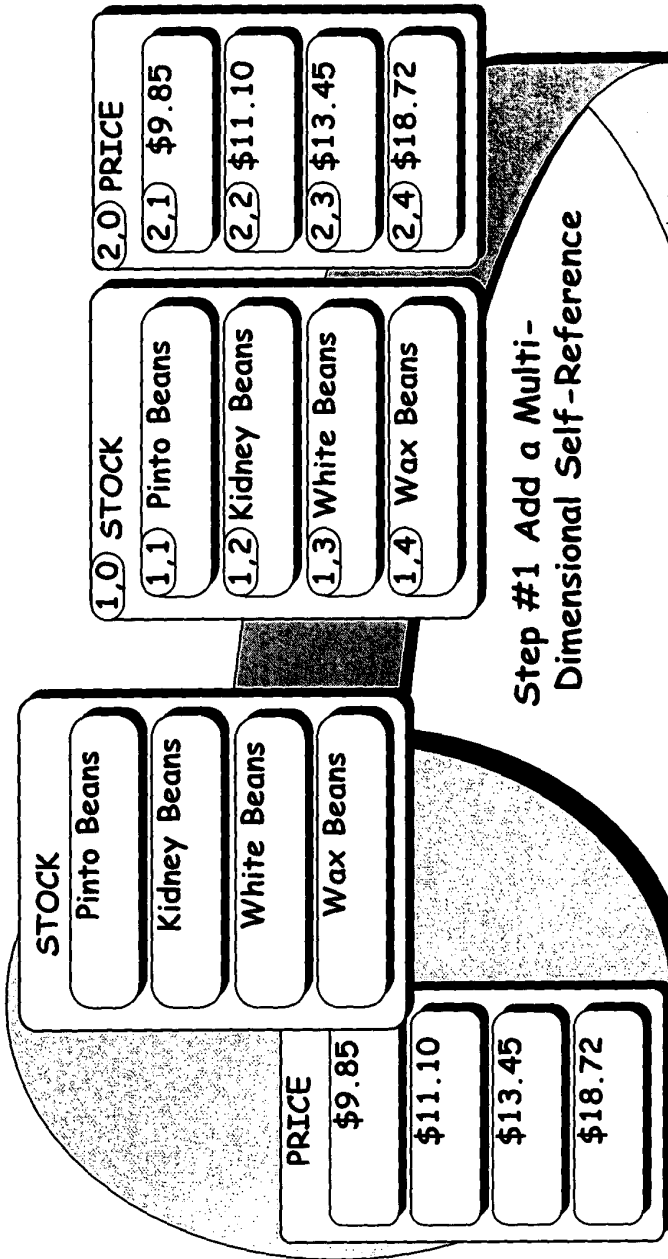
[row Context]

Drawing 5. Assimilation of Relationships to KnOS Contexts

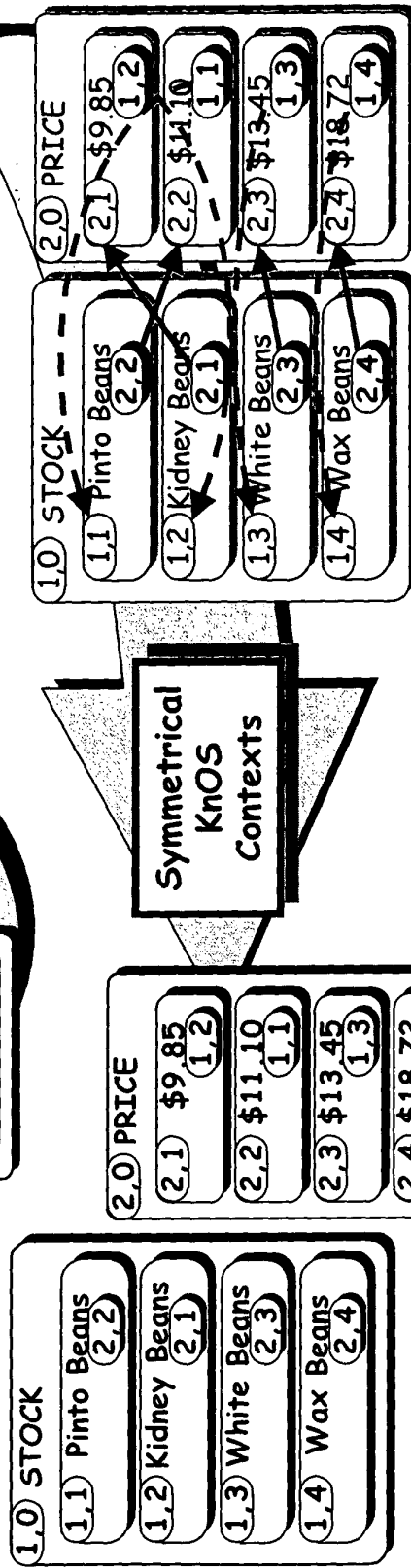
STOCK



Begin
with a pair
of attributed
Contexts



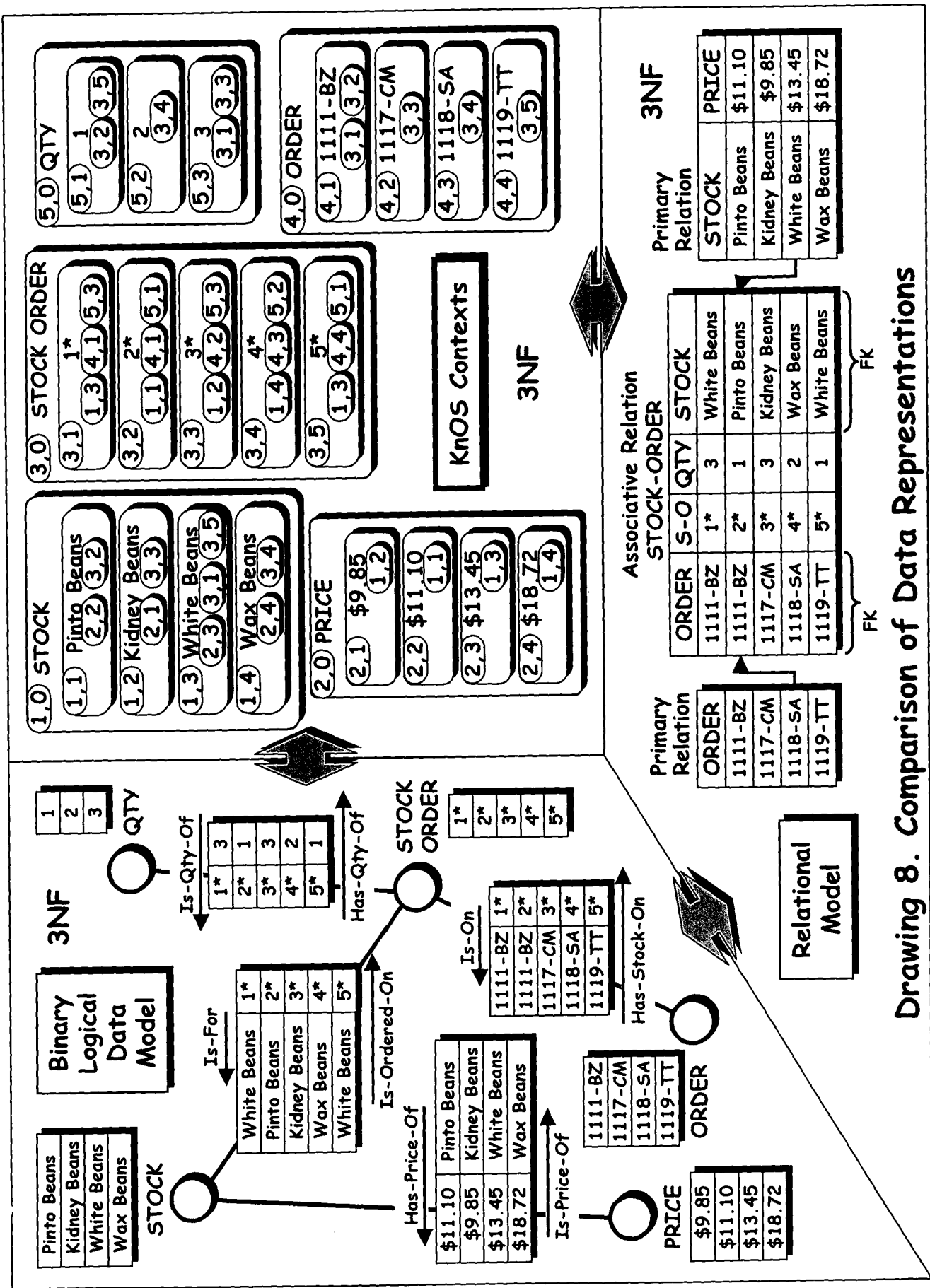
Step #1 Add a Multi-
Dimensional Self-Reference



Step #2 Insert an Explicit Reference
for each Association

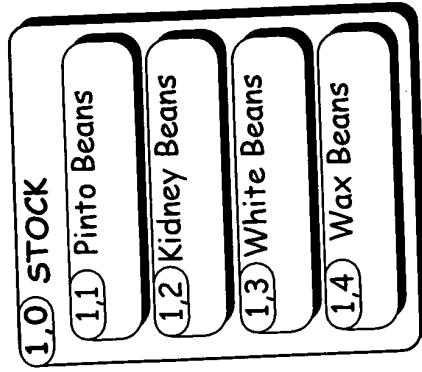
Symmetrical
KnOS
Contexts

Drawing 7. Representing Binary Associations in KnOS Contexts



Drawing 8. Comparison of Data Representations

Why is a KnOS Context *Application Independent*?



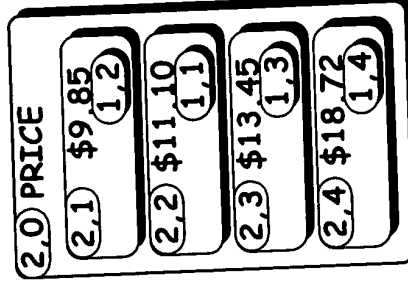
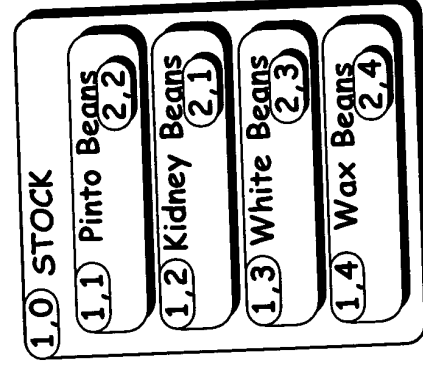
STOCK
+
PRICE

A fundamental change in the application, like adding a PRICE attribute to the STOCK relation

{Reference-Data Instance-VKSet}

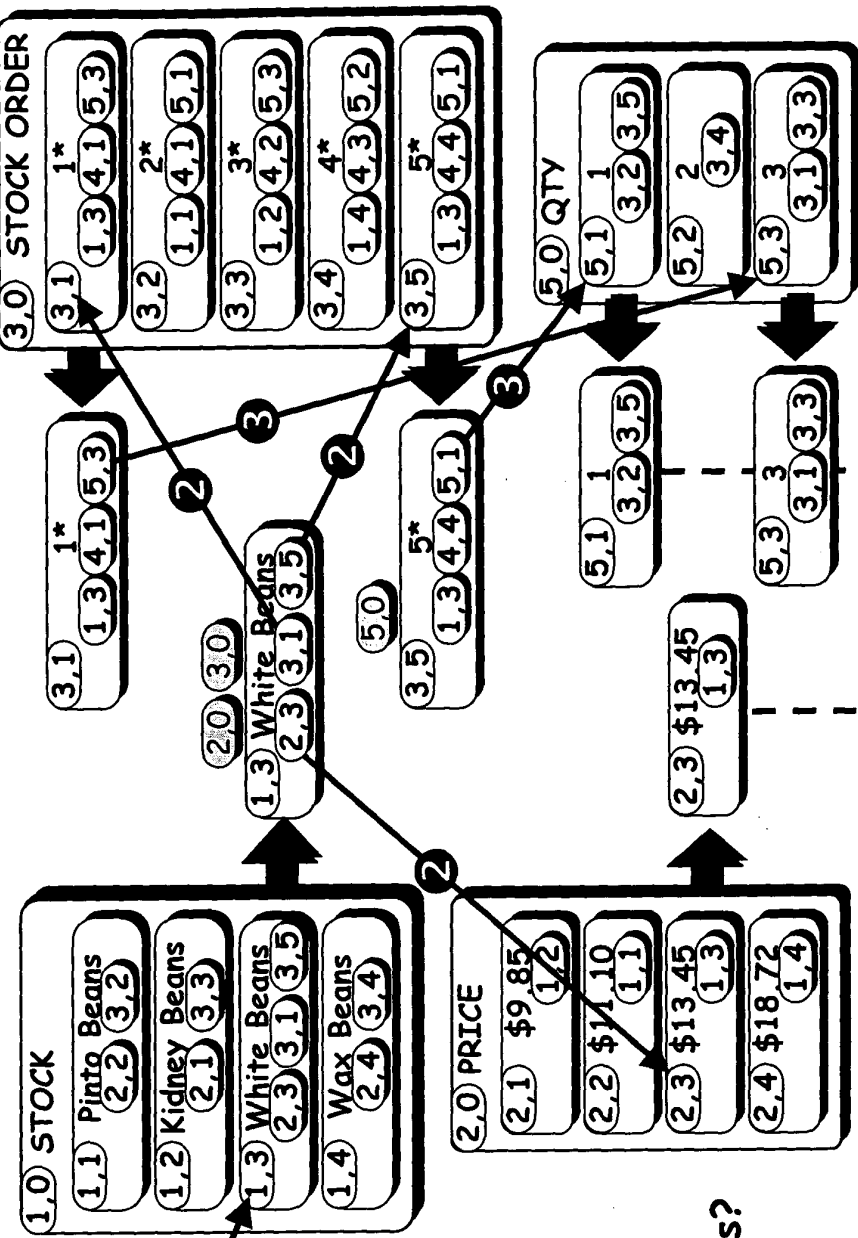
.... does not
alter the *structure* of the
STOCK Context

=



{Reference-Data Instance-VKSet}

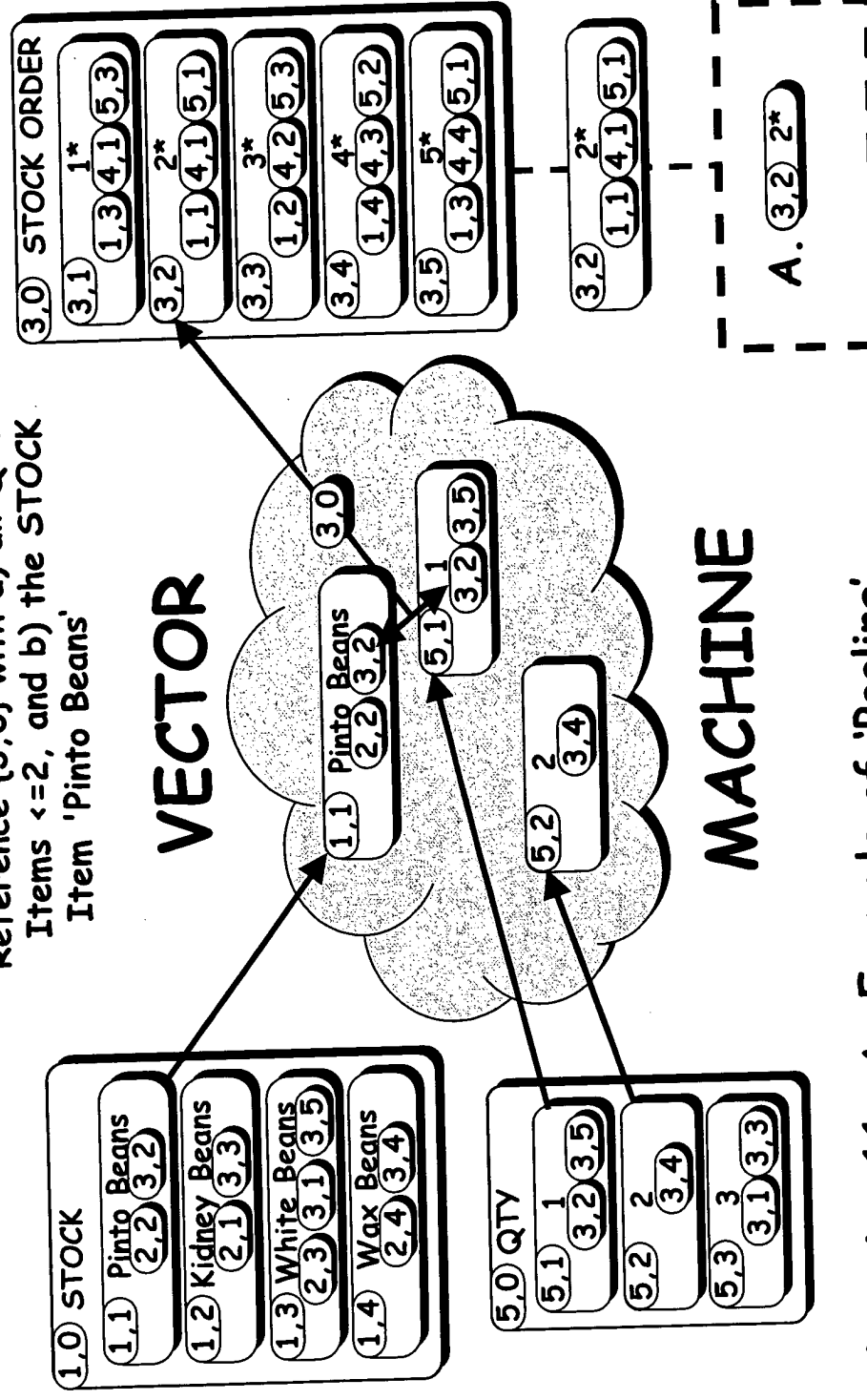
Drawing 9. Application Independence



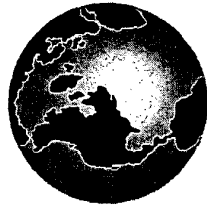
Q. Which STOCK-ORDER Items for "Pinto Beans" have a QTY <= 2

3.0

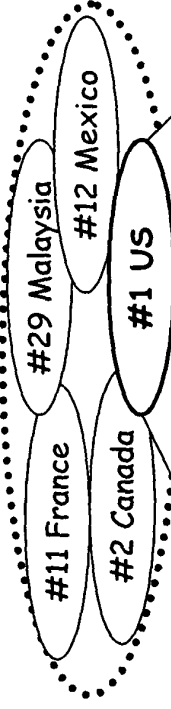
A. 'Pool' the STOCK-ORDER Context Reference {3,0} with a) all QTY Items ≤ 2 , and b) the STOCK Item 'Pinto Beans'



Drawing 11. An Example of 'Pooling'



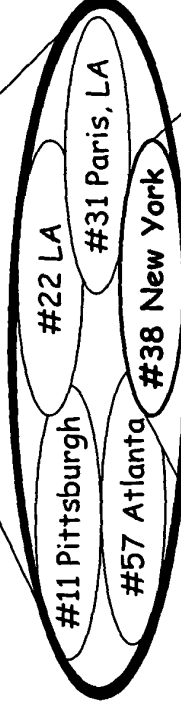
World
View



->

Environment #1 ->

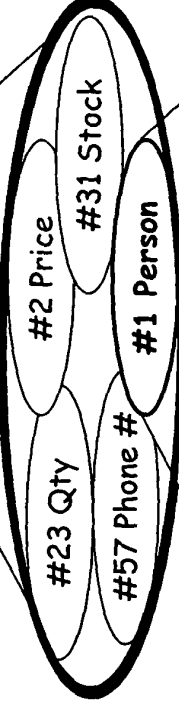
All US
Offices



->

Repository #38 ->

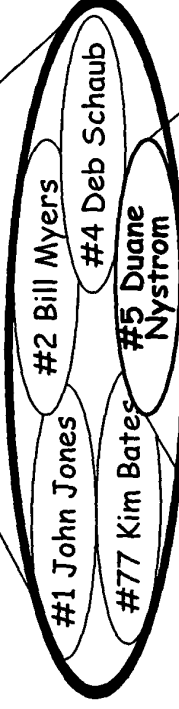
The New
York
Office



->

Context #1 ->

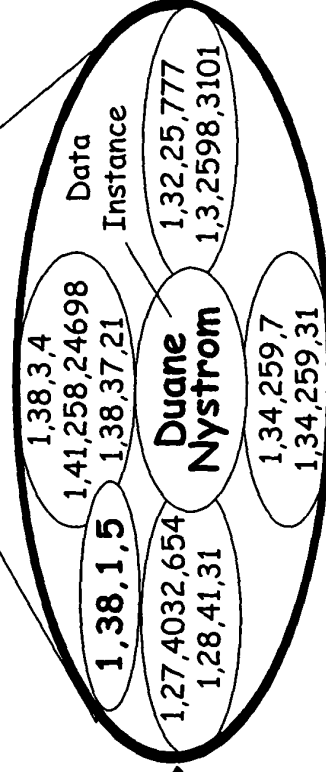
'Person'



->

Item #5 ->

Item

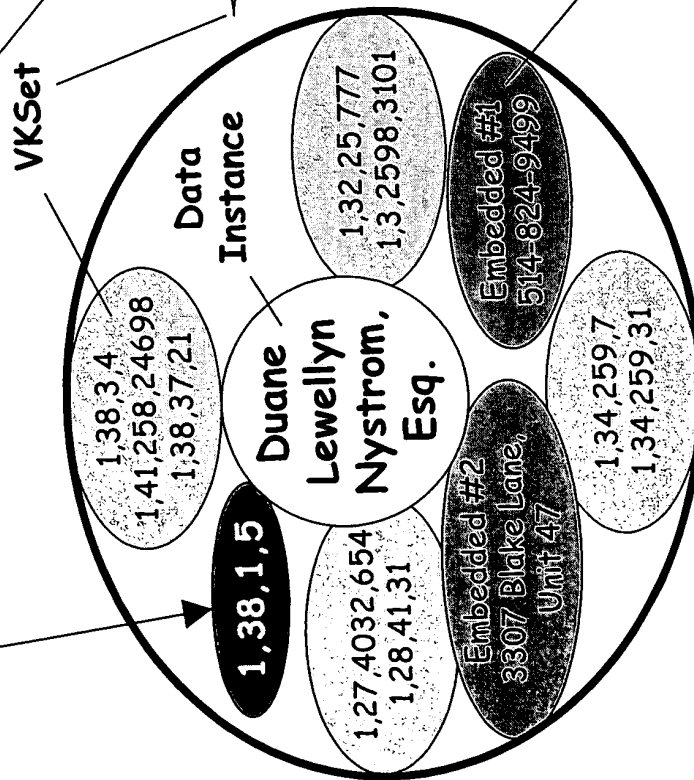


->

Drawing 12. Multi-Dimensional Reference Model

Item {1,38,1,5}

Each numeric "cell"
is binary = 2^{30}
= 0 to 1,073,741,824

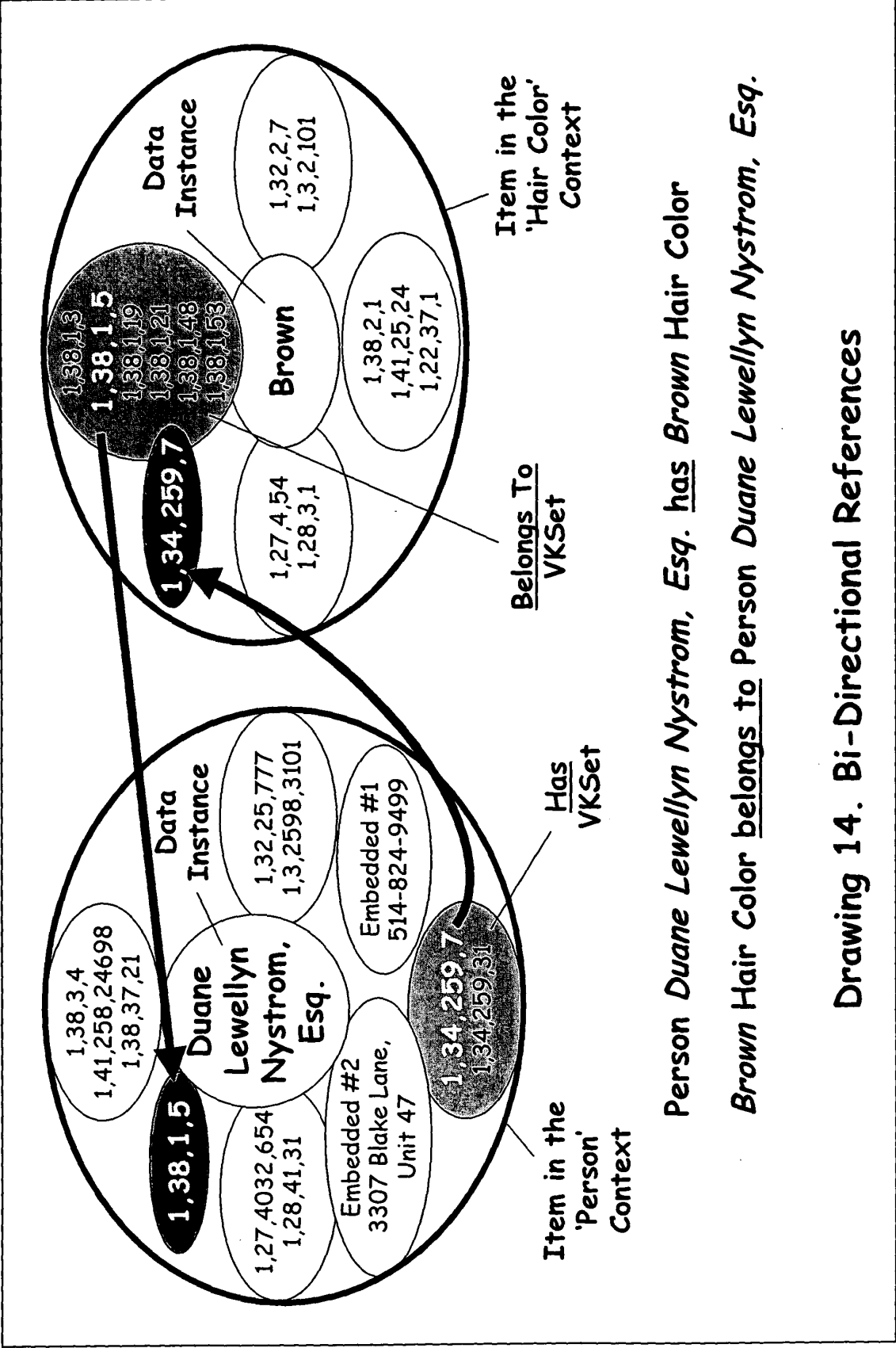


Each "cell" = 1 word, 32 bits

Drawing 13. Structure of a KnOS Item

E R C I

Self Reference	1	38	1	5
Item Map	Status	Flags	Size of Item Data = 7 wds	Size of Embedded = 12 wds
Item Data	# of Parents = 3	# of Kids = 2	# of Links = 2	# of Related = 2
	'Duan'	'e Le'	'well'	'yn_N'
	'ystr'	'om, '	'Esq.'	
Parent	1	38	3	4
Parent	1	41	258	24698
Parent	1	38	37	21
Kid	1	34	259	7
Kid	1	34	259	31
Link	1	27	4032	654
Link	1	28	41	2277
Related	1	32	25	777
Related	1	3	2598	3101
Embedded Elements	# = 2	Size of E1 = 4 wds	'514'	'824'
	'9499'	Size of E2 = 7 wds	'3307'	'Bla'
	'keL'	'ane'	'Uni'	't 47'

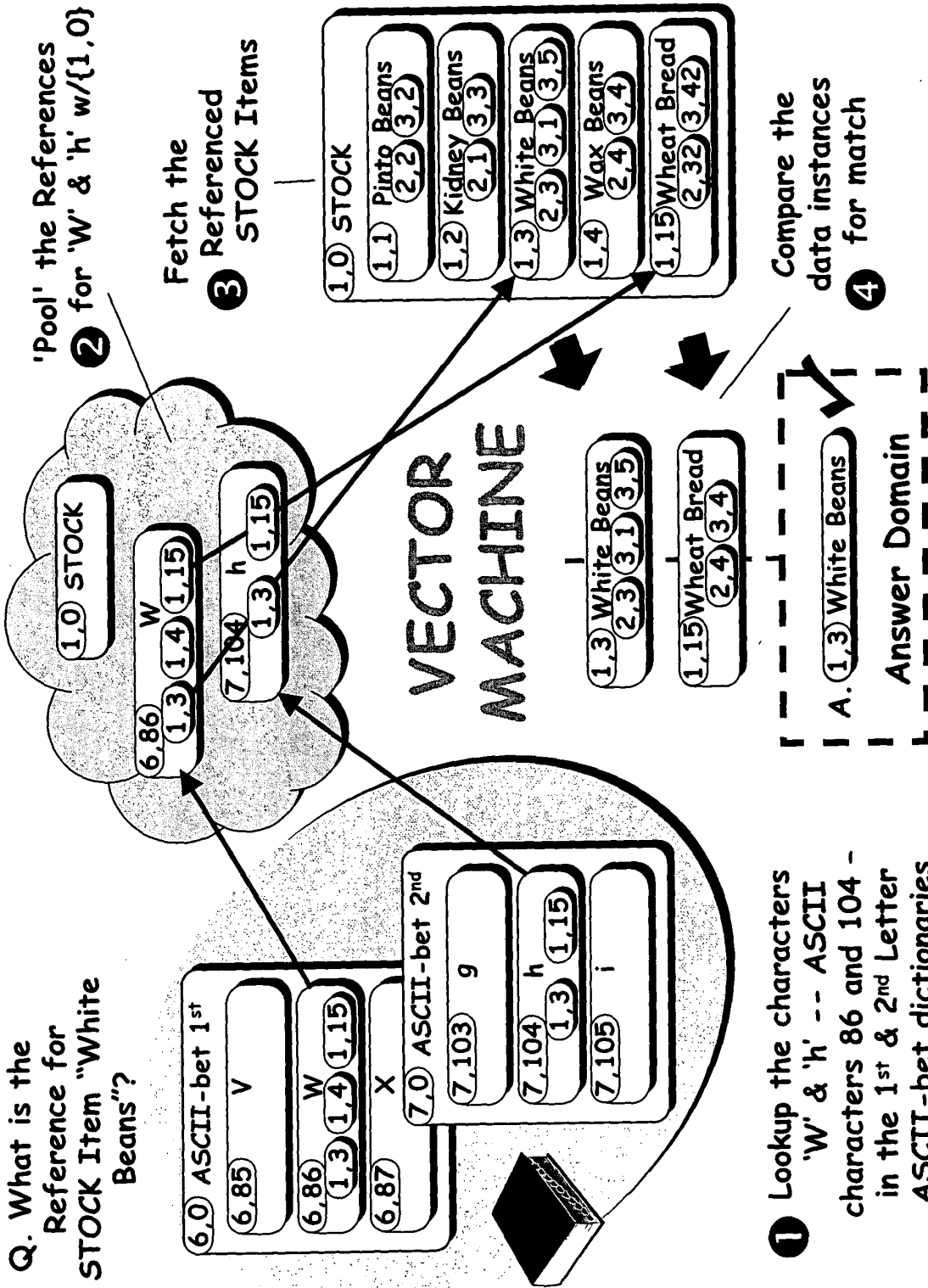


Person Duane Lewellyn Nystrom, Esq. has Brown Hair Color

Brown Hair Color belongs to Person Duane Lewellyn Nystrom, Esq.

Drawing 14. Bi-Directional References

Q. What is the Reference for STOCK Item "White Beans"?



Drawing 15a ASCII-betical Conversion

Q. What is the KnOS Reference for "Duane Lewellyn Nystrom, Esq.", a 'Person'?

Context #1: Dictionary 1

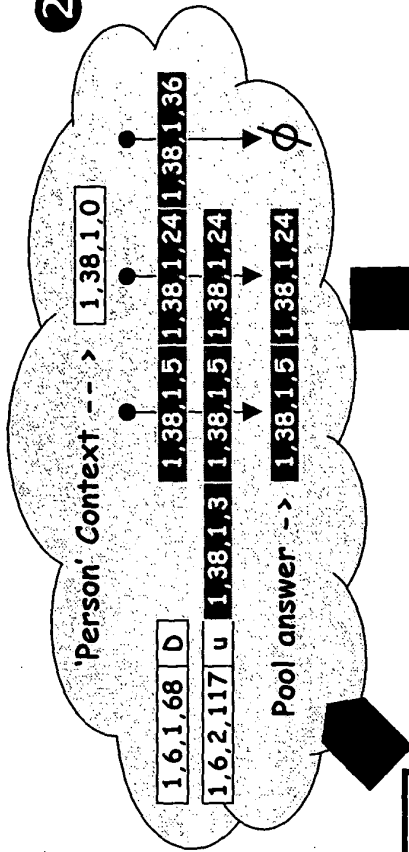
1,6,1,0	1	VKSets	
...	...		
1,6,1,67	C	1,38,12,43	
1,6,1,68	D	1,38,1,5 1,38,1,24 1,38,1,36	
1,6,1,69	E	1,38,12,46	
1,6,1,70	F	1,38,324,51	
...	...		

Context #2: Dictionary 2

1,6,2,0	2	VKSets	
...	...		
1,6,2,116	t	1,38,4,55	
1,6,2,117	u	1,38,1,3 1,38,1,5 1,38,1,24	
1,6,2,118	v	1,38,1,57	
1,6,2,119	w	1,38,1,73	
...	...		

- Look up the characters 'D' & 'u' -- ASCII characters 68 and 117 - in the 1st & 2nd letter ASCII-bet dictionaries

- 'Pool' the kid References for {1,6,1,68} & {1,6,2,117} w/{1,38,1,X}



Cont #38: Person

1,38,1,0	Person	
...	...	
1,38,1,5	Duane Lewellyn Nystrom, Esq.	
...	...	
1,38,1,24	Duane Lee Guy	
...	...	

- Fetch the Matching References in 'Person'

Convert --> "Duane Lewellyn Nystrom, Esq."

1,38,1,5	Duane Lewellyn Nystrom, Esq.
1,38,1,24	Duane Lee Guy, Jr.

- Compare the ASCII Data Instances on all Reference Matches

✓ A. 1,38,1,5 = "Duane Lewellyn Nystrom, Esq."

Drawing 15_b ASCII-betical Conversion

Repository #6

Step 1: Context Directory
 Context Directory: #1 | #2 | #7 | #8 | ...
 Actual '# of the Context': {C,R,N,O} {8,3,1,5}
 Relative Position in the Context Locator Directory: 8

Step 2: Context Locator
 Context Locator: * | 9 | #8 | #1 | #7 | 0
 Relative Position in the Context Locator Directory: 5

Step 3: Context BLOBs
 Context BLOBs: #2 | #7 | #8 | #1
 Page Offset to Context BLOBs: 0, 3, 5, 9
 Fixed Page Size: 0, 6, 8, 0, ...

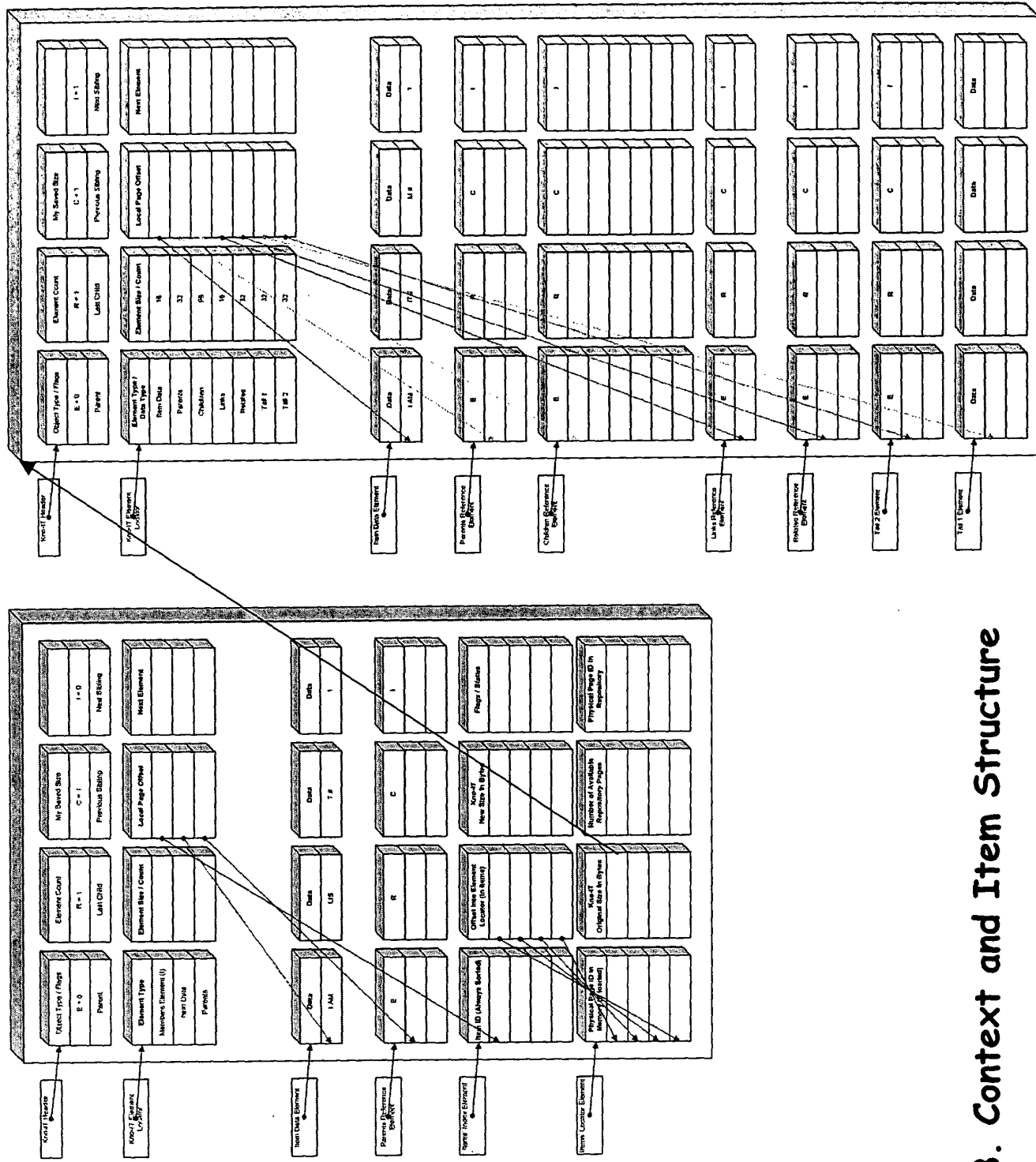
Step 4: Item Directory For Context #8
 Item Directory For Context #8: #1 | #2 | #5 | #6
 Relative Position in the Item Locator Directory: 3

Step 5: Item Locator
 Item Locator: #5 | 0 | #2 | #6 | * | 9
 Relative Position in the Item Locator Directory: 7

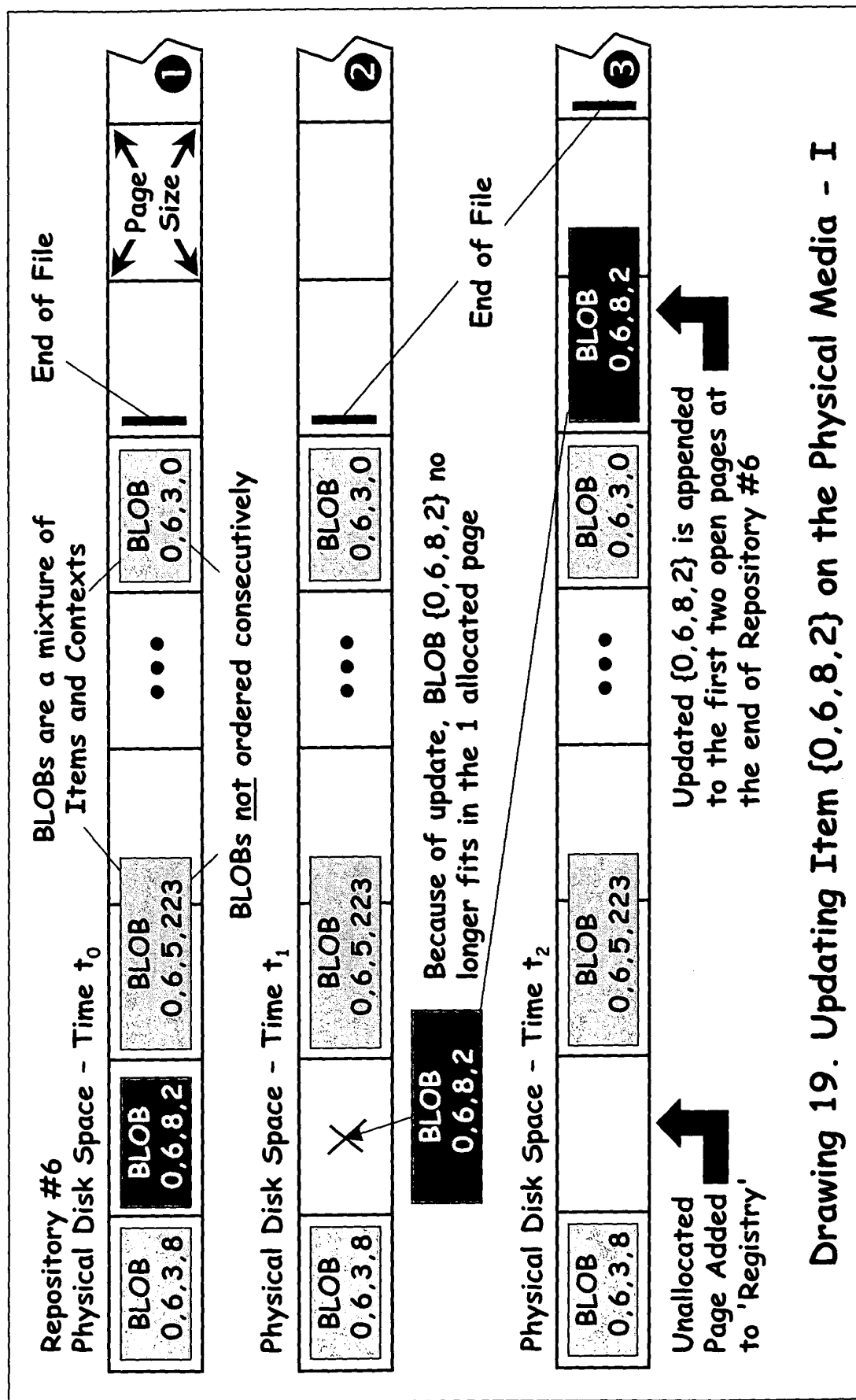
Step 6: Item BLOBs
 Item BLOBs: #1 | #5 | #2 | #6
 Page Offset to Item BLOBs: 0, 2, 7, 9
 Actual '# of the Item': {E,R,C,I} {0,6,8,2}

Drawing 16. Locating Item {0,6,8,2} on the Physical Media

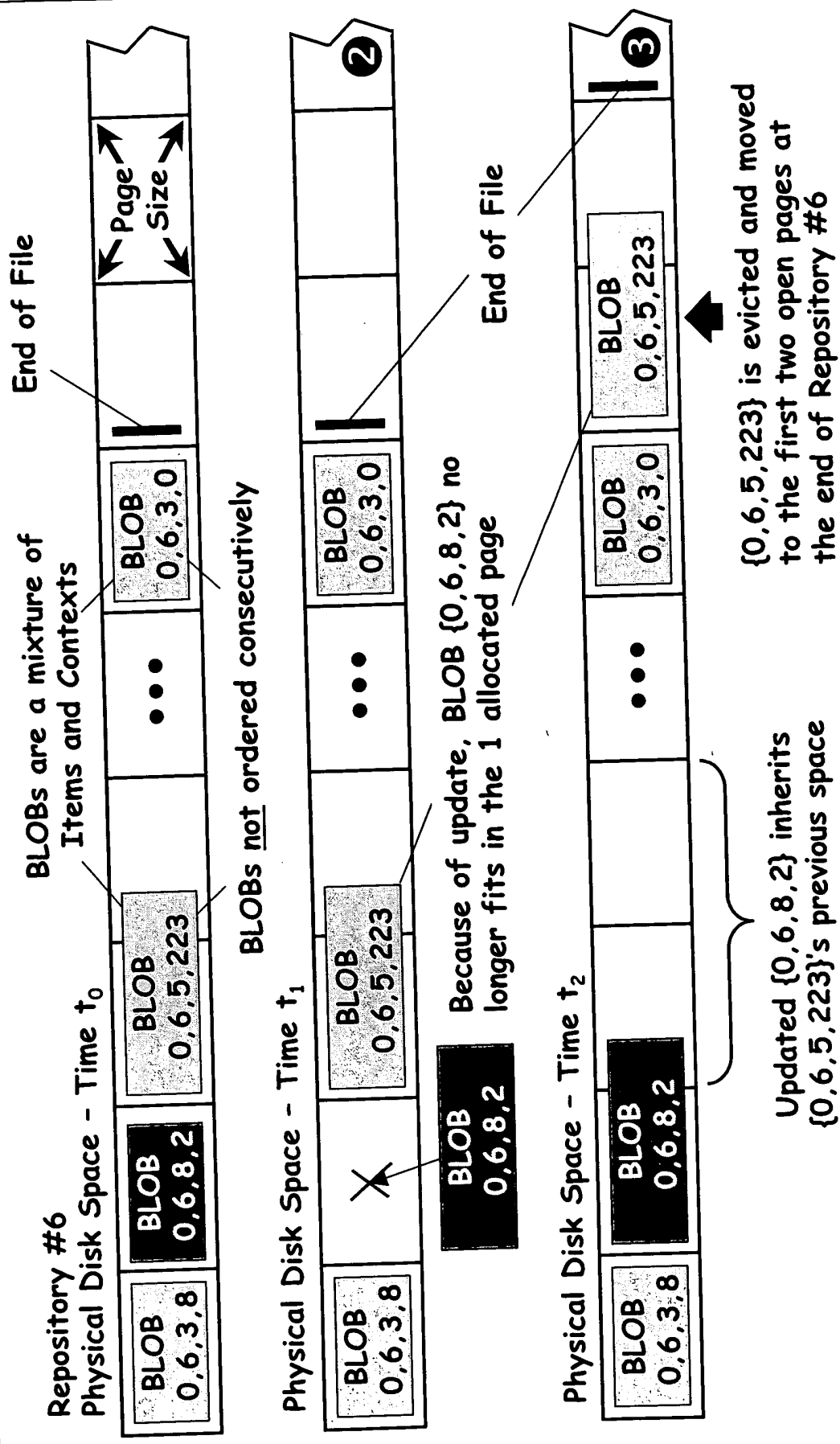
Drawing 16. Locating Item $\{0,6,8,2\}$ on the Physical Media



Drawing 18. Context and Item Structure



Drawing 19. Updating Item {0,6,8,2} on the Physical Media - I

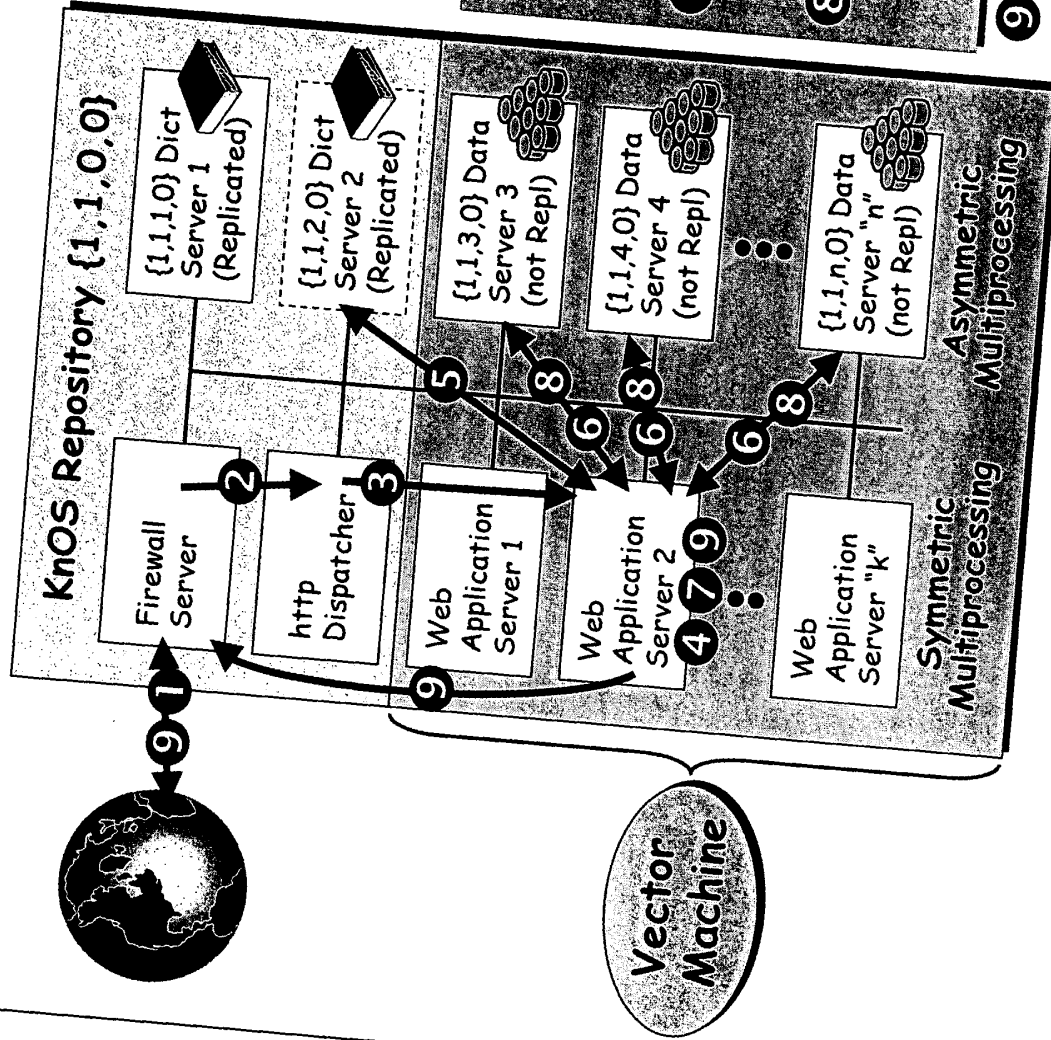


Drawing 20. Updating Item {0,6,8,2} on the Physical Media - II

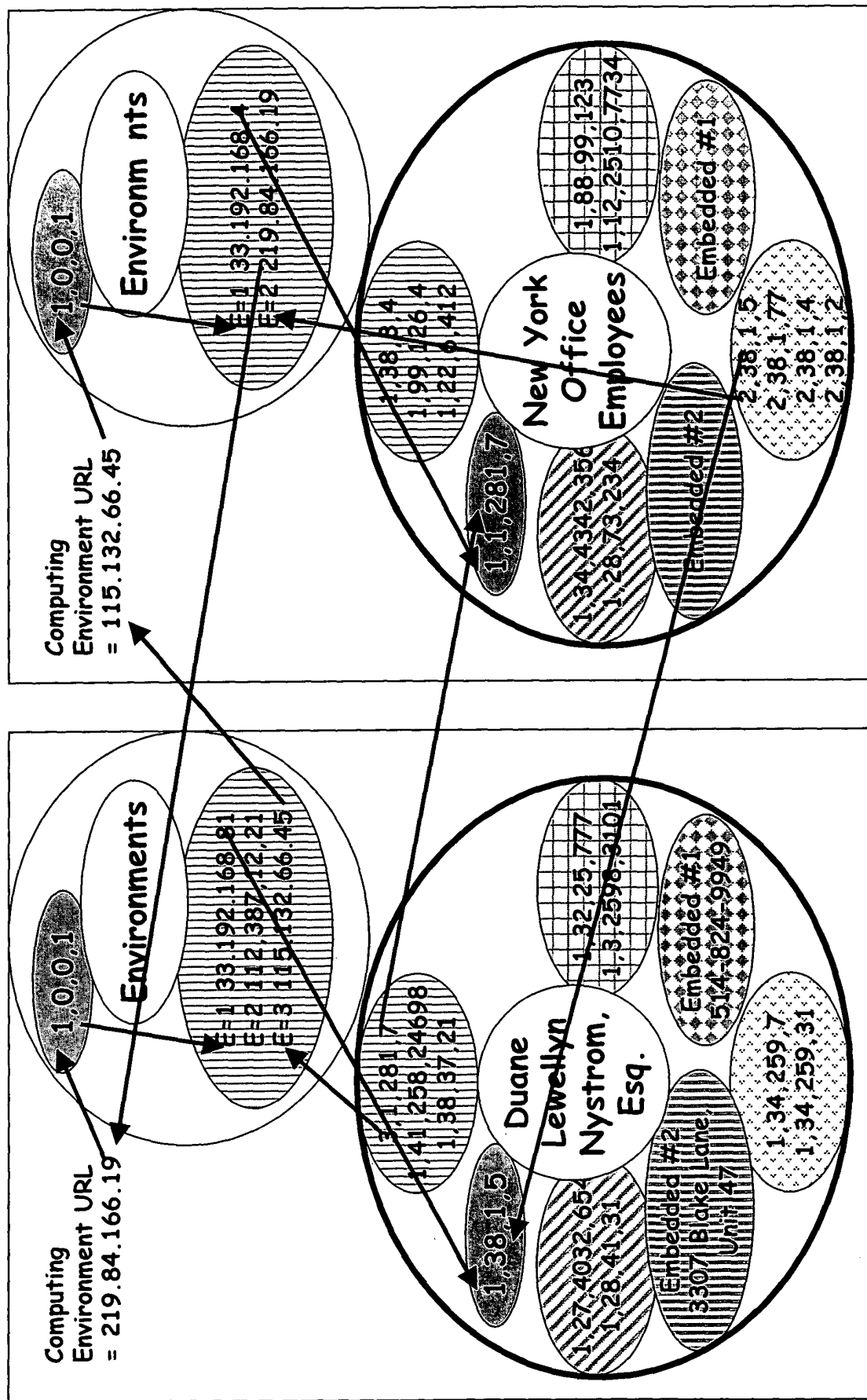
- ### Typical Query Transaction
- 1 Receives http over Internet
 - 2 Forwards to http Dispatcher
 - 3 Authenticates credentials & Dispatches to #2 Web Application Server (based on idle capacity)
 - 4 Parses http/html, establishes session
 - 5 Tasks Dictionary {1,1,2,0} to convert transaction parameters; Dictionary {1,1,2,0} returns requested *References*

- 6 Issues *Referenced* fetches to {1,1,3,0} to {1,1,n,0} {1,1,3,0} to {1,1,n,0} fetch & return Items containing all potentially-relevant data
- 7 Performs vector operations
=> Repeats 6 and 7 until completion of the transaction
- 8 Issues *Referenced* fetches to {1,1,3,0} to {1,1,n,0} for answers; {1,1,3,0} to {1,1,n,0} fetch & return the Items

- 9 Packages response in http/XML & replies to requester via firewall

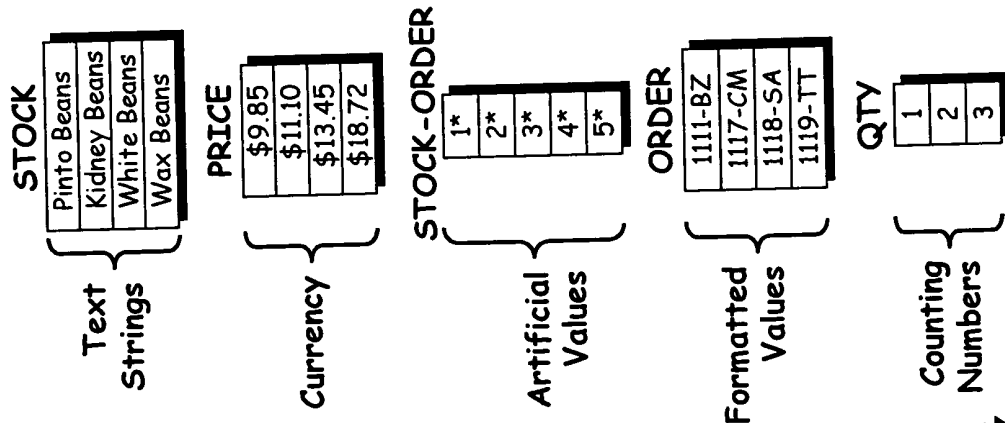


Drawing 21. KnOS Scalability

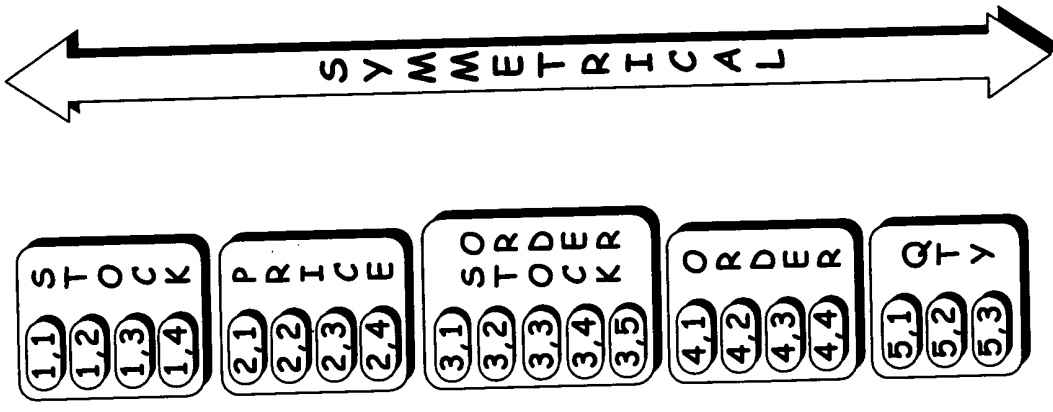


Drawing 22. Inter-Referencing between Computing Environments

ASCII VALUES



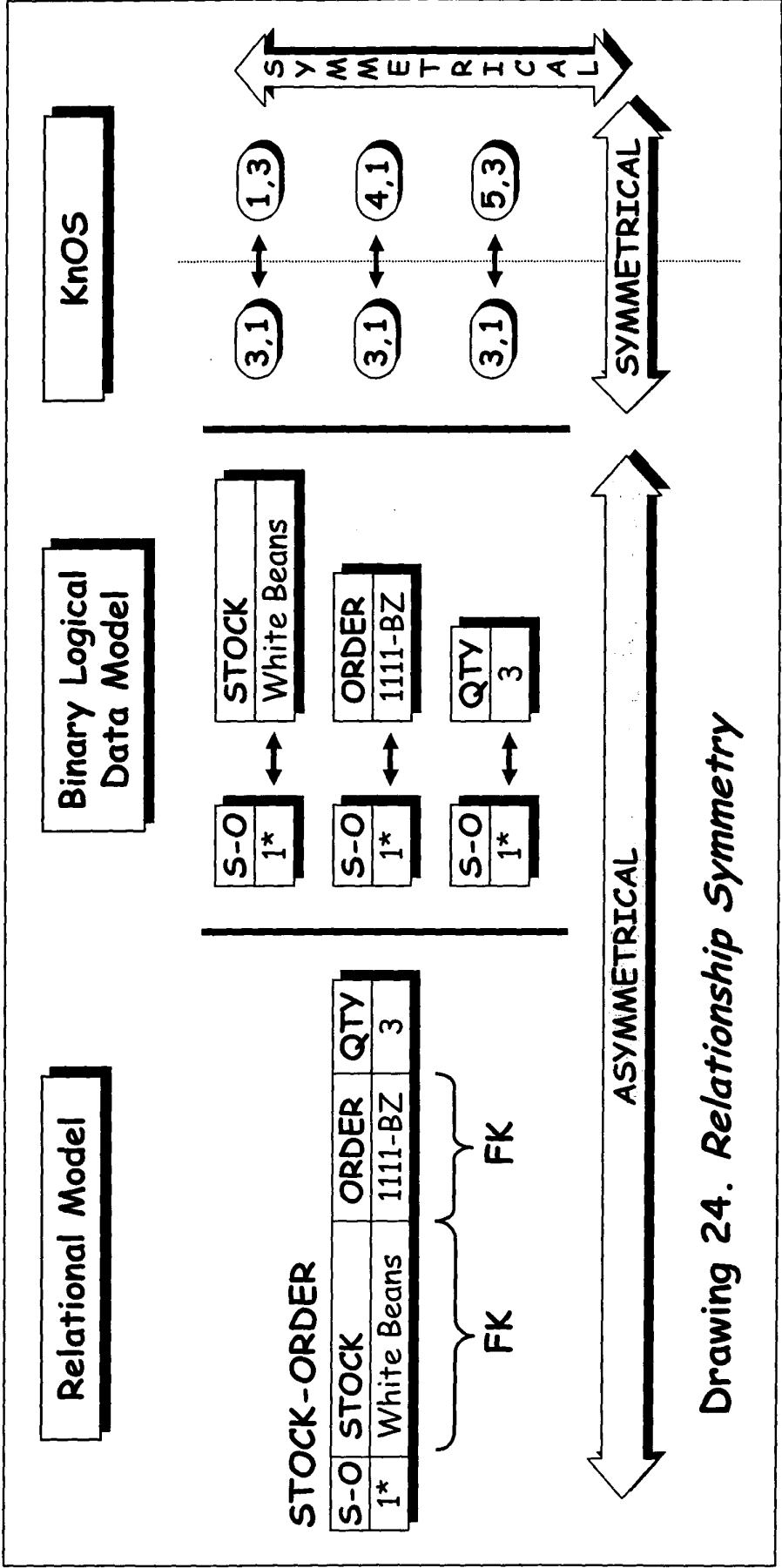
Reference Vector Key



SYMMETRICAL

ASYMMETRICAL

Drawing 23. Value Symmetry



Drawing 24. Relationship Symmetry

Associative Relation

STOCK=ORDER

Primary Relation

ORDER	S-O	QTY	STOCK
1111-BZ	1*	3	White Beans
1111-BZ	2*	1	Pinto Beans
1117-CM	3*	3	Kidney Beans
1118-SA	4*	2	Wax Beans
1119-TT	5*	1	White Beans

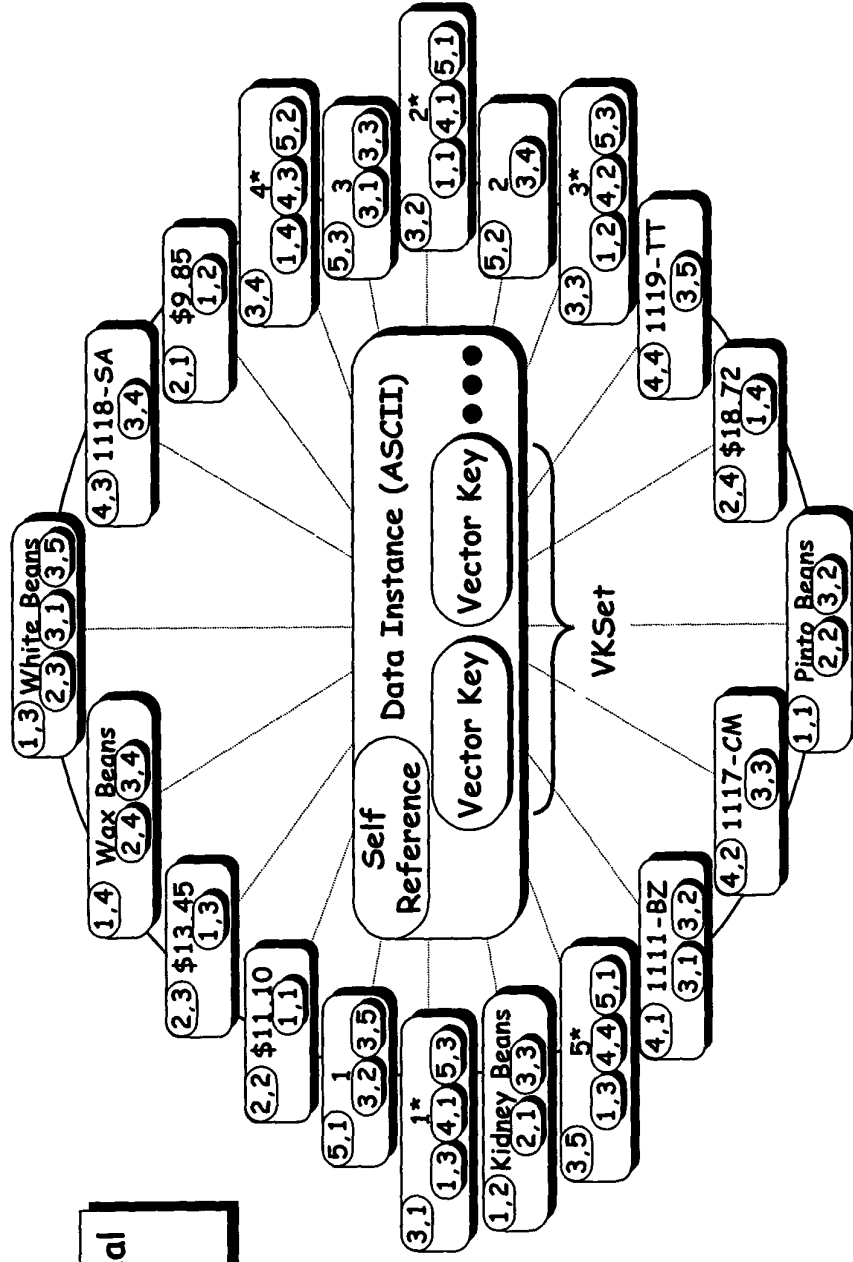
Primary Relation

STOCK	PRICE
Pinto Beans	\$11.10
Kidney Beans	\$9.85
White Beans	\$13.45
Wax Beans	\$18.72

20 distinct ASCII values embedded in Asymmetrical rows & columns of Asymmetrical tables

Symmetrical KnOS Items

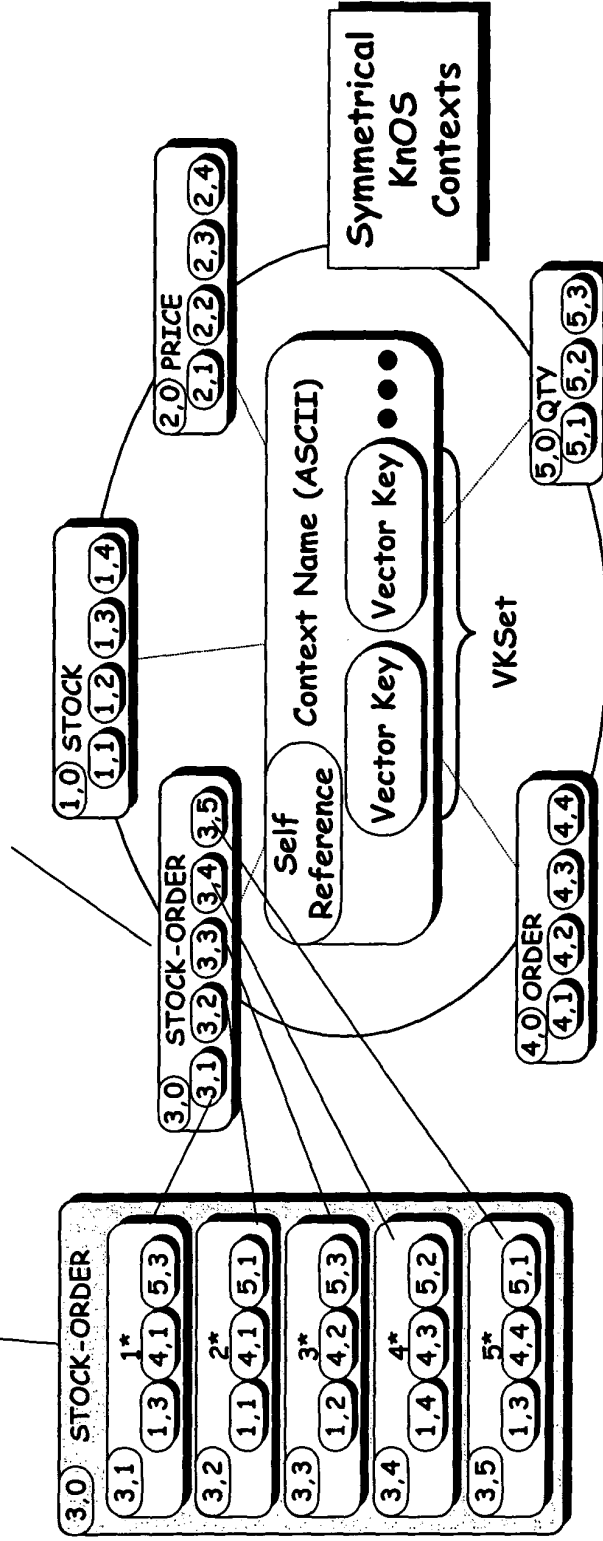
20 Symmetrical Item structures w/19 encapsulated bi-directional relationships referenced with Vector Keys & stored in VKSets



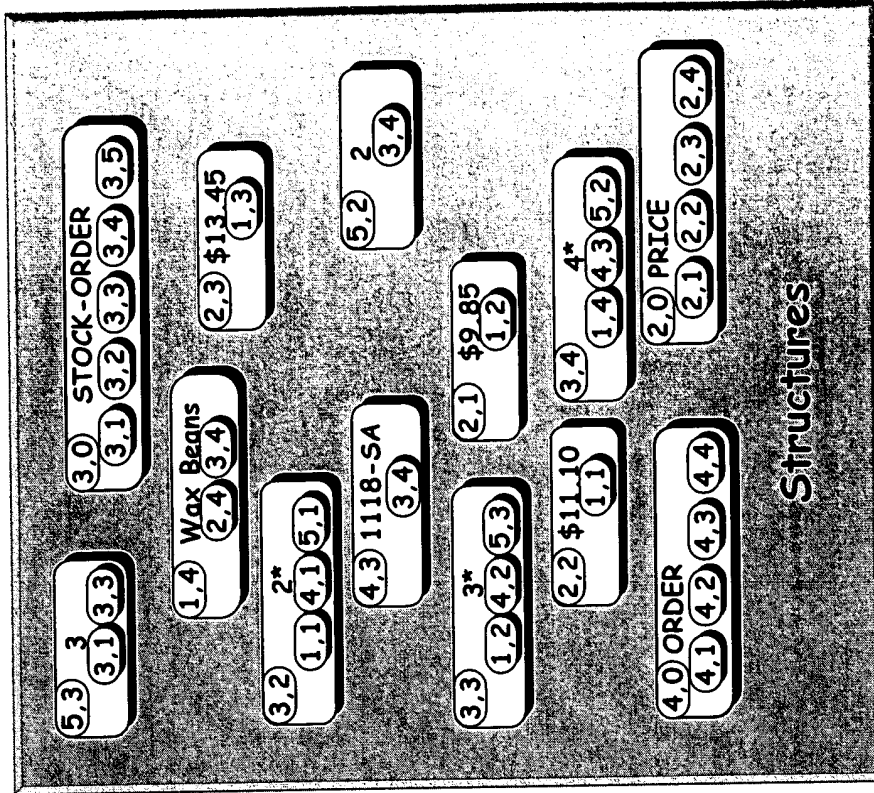
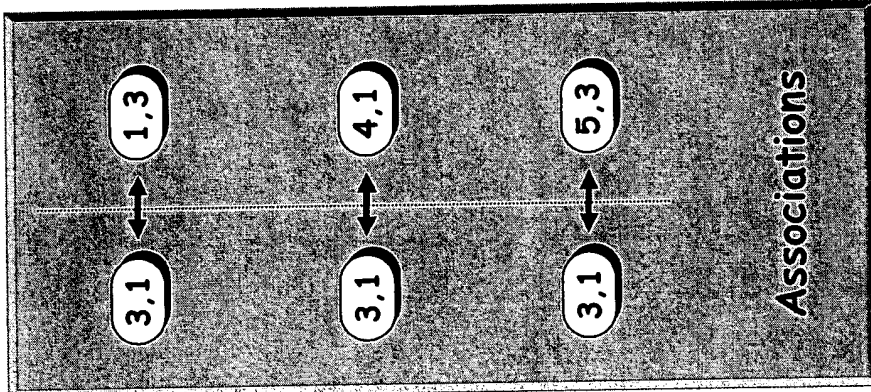
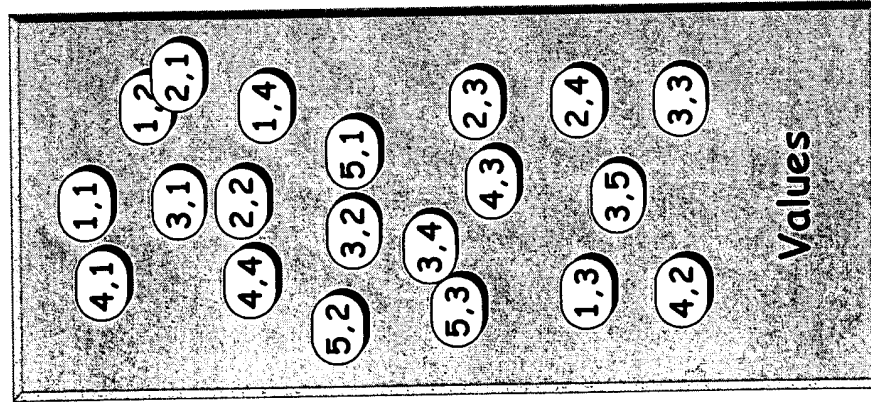
Drawing 25. Structural Symmetry - KnOS Items

Notionally, the Context, in this case STOCK-ORDER, physically Encapsulates the dependent Items, as shown here

In fact, Contexts look like Items, with self-references, Context names and associations, expressed as Vector Keys (VK) and stored in VKSets. The Vector Keys point to all of the Items in the given Context.



Drawing 26. Structural Symmetry - KnOS Contexts



Drawing 27. KnOS Symmetry

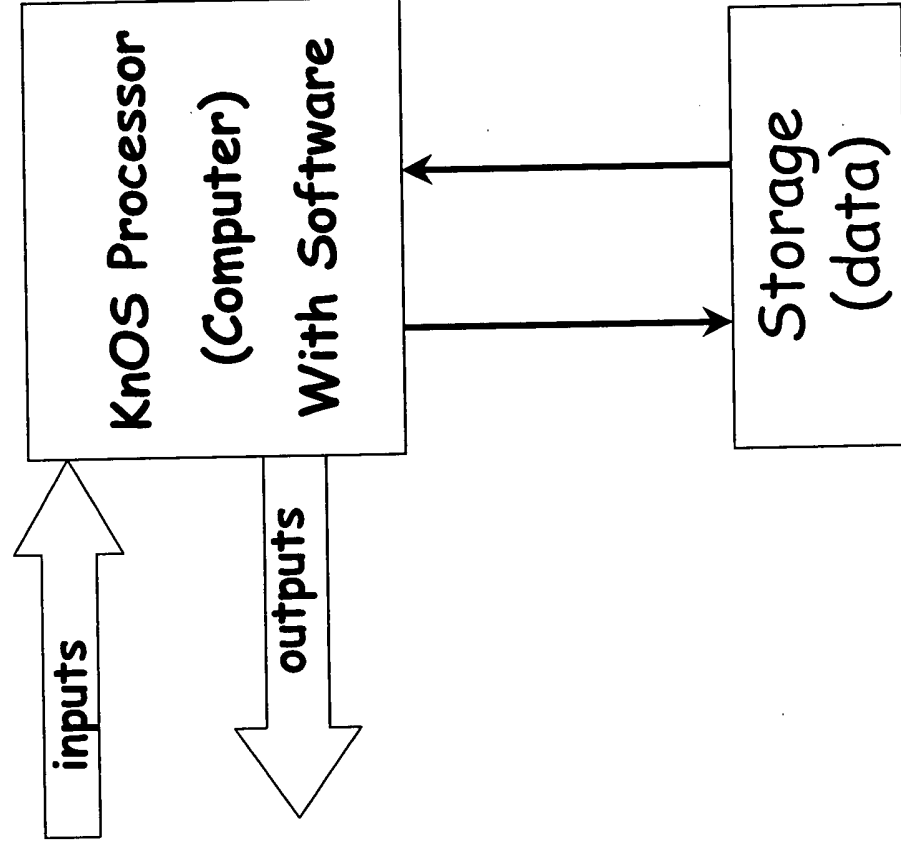


Figure 28

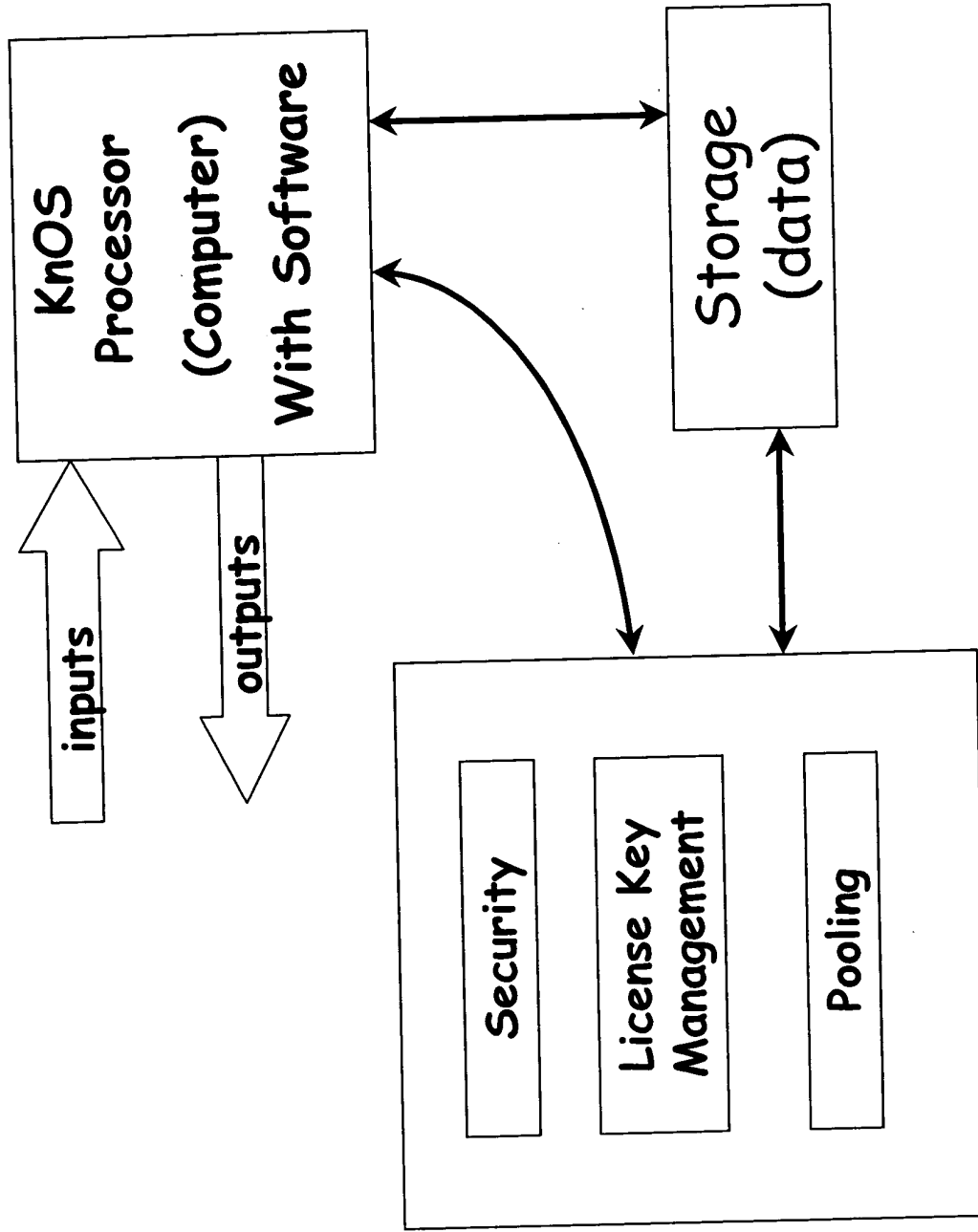


Figure 29

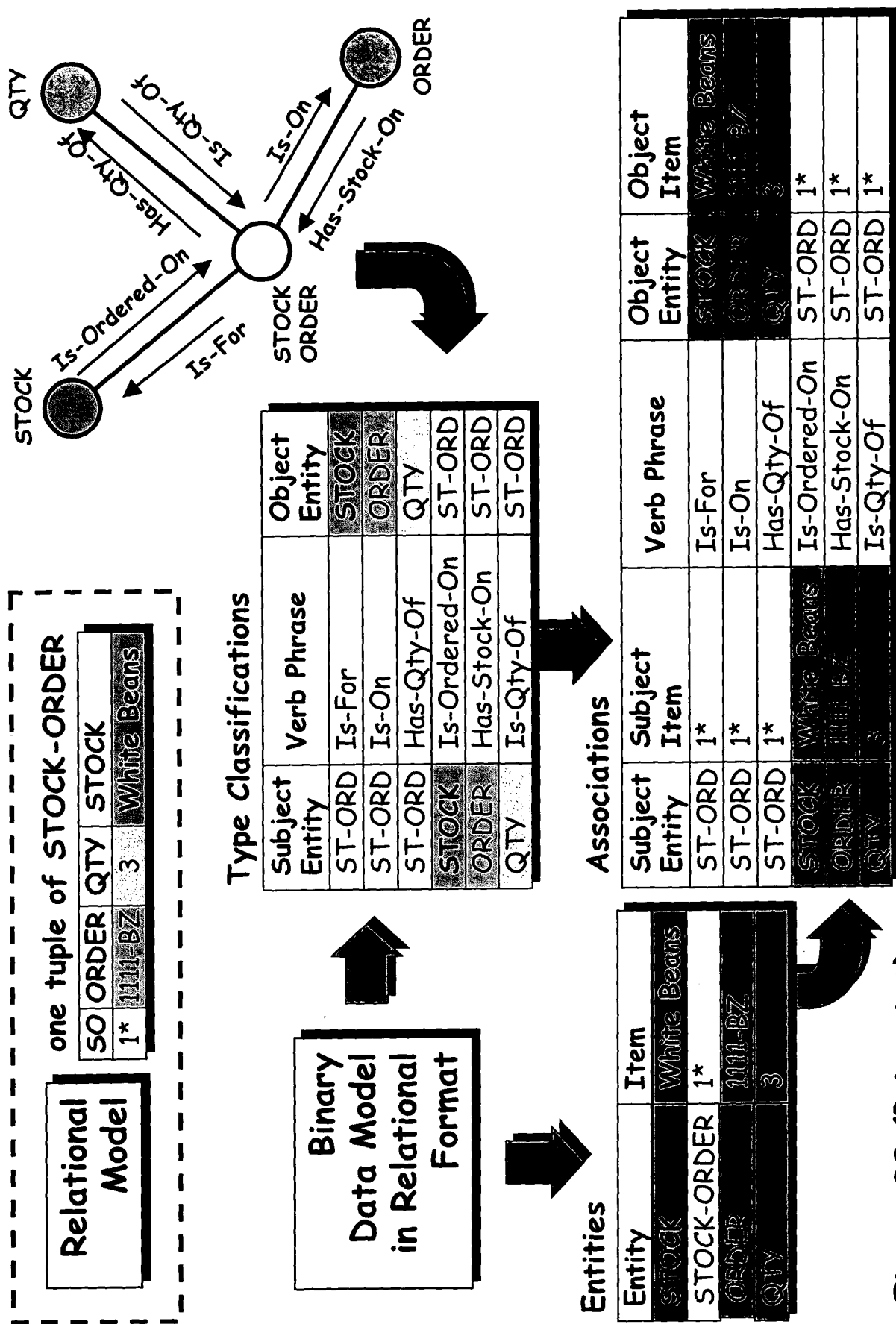


Figure 30 (Prior Art)
A Comparison of Compactness